

## Method for Implementing Wide Area Centrex

### Field of the Invention

The present invention relates to the technique of the switch in communication system, and particularly, to a method for implementing Wide Area Centrex.

### 5 Background of the Invention

It is common knowledge that 80% of the income of telecommunication comes from 20% of the clients, namely the big clients. Now, the importance of the big clients to the operators is self-evident in the increasing telecommunication competition. The enterprises and big clients require high-standard quality of telecommunication  
10 services due to their special service needs, and the focus of competition among operators for attracting the big clients is to provide value-added services capable of bringing significant benefits to the big clients while satisfying the basic requirement of voice service and data service, and the Central Exchange (Centrex) service is one of the popular value-added services.

15 The so called Centrex service regards some aggregative users as a user group and provides the group with various service functions, such as calling each other in the group with short numbers. Herein, the short number is the number valid only in the group and usually has fewer digits. At present, however, the Centrex service provided by a stored-program control switch is only allowed to be used within the exchange.  
20 That is to say, extensions can call each other with short numbers only when they are in the same user group of one exchange. Users belonging to one aggregative client but covered by Centrex of different exchanges have to call each other with the uniform numbers in the Public Switched Telephone Network (PSTN), which is a long number.

25 However, users belonging to one aggregative client but covered by different exchanges may desire to call each other with short numbers as well. Then Wide Area Centrex (WAC) needs to be provided for the aggregative client. WAC is to combine the Centrex of different switch nodes into a virtual cross-region private network through physical and signaling connection. Though such a private network is dispersed in regions, it is similar to a single Centrex in performance and use. That is

to say, WAC users also have two numbers: a long number and a short number. Besides the basic calling and complementary services of the PSTN, the users in the group can enjoy many special complementary services similar to those provided by a Private Automatic Branch Exchange (PABX), such as calling each other via short numbers within the group. Further, a telephonist can be configured in each group to assist out-group, into-group and in-group calling. A call center can also be established to assist the calling of many Centrex groups simultaneously.

WAC service can be implemented through the Intelligent Network(IN) in the prior art, namely the so called 600 service, in which multiple cities are covered by the intelligent network such that users could call each other with short numbers. Such a service is in fact a result of combining WAC and the Virtual Private Networking (VPN) of the IN service.

The structure of a WAC system implemented through the IN is illustrated in Figure 1, including users 10, 11 and 12, Local Switch (LS) 22, Service Switch Point (SSP) 30, and Service Control Point (SCP) 40, wherein LS can be classified into two types, one is LS21 which supports attribute judgement and number transformation for WAC users, and the other is LS22 which does not support attribute judgement and number transformation for WAC users. In addition, SCP 40 includes the long number and short number corresponding table, which is used for saving the corresponding relationship between the long numbers and the short numbers of the WAC users.

The process of using LS21 which supports attribute judgement and number transformation for WAC users in the prior art is hereinafter described in detail: Provided that user 10, who has the short number 5001 and long number 5550888, wants to call a cross-region user 12 who has the short number 7001 and long number 7770888 in the same group. At this time, user 10 may dial the short number 7001 to LS21 directly. After LS21 finds that the short number is not a short number of its own exchange, it adds 600N1N2 before the short number automatically, which changes the short number into 600N1N2+7001, then directs and connects the 600 route to SSP 30. After detecting the intelligent call, SSP 30 reports the intelligent call to SCP 40. SCP 40 finds the long number being called is 7770888 based on the long number 5550888 of the calling and the short number 7001 of the called. Then, SCP 40 instructs SSP 30

to connect to the long number being called 770888. Thereafter, the connecting process between SSP30 and the called is the same as an ordinary call.

The process of using LS 22 which does not support attribute judgment and number transformation for WAC users in the prior art is as follows: Provided that user 5 11, who has the short number 6001 and long number 6660888, wants to call a cross-region user 12 who has the short number 7001 and long number 7770888 in the same group. At this time, user 11 needs to dial 600N1N2+7001 to LS 22, then LS 22 directs and connects the 600 route to SSP 30. Thereafter, the process is the same as above.

Besides being implemented by using the IN, WAC can be implemented by the 10 method of distributed number memorization and transformation. In such a case, the inter-exchange relay signaling of the LS is the Integrated Services Digital Network (ISDN) User Part (ISUP) while the inter-exchange support for the extended Signaling Connection Control Part (SCCP) is required. As shown in Figure 2, suppose that WAC is configured for two LS, every LS uses the switch of Internet Service Provider 15 (ISP) board, and all the long number and short number corresponding tables of the WAC users in the group are saved in the switches used. The switches set up the communication path of SCCP via the PSTN. When an in-group call is made, the number of the group and the short number are sent to the ISP to inquire about the corresponding long number. The inquired long number may be the number of the 20 same exchange or that of another exchange, and an in-exchange call or a cross-exchange call is implemented after an analysis of the long number. Herein, route data of the Message Transfer Part (MTP) ,which enable the telephone station to conduct cross-switch management of the data of the WAC users in the group and obtain phone bills across exchange by means of SCCP signaling ,are configured between the LS,.

25 In such a manner of implementation, the user data of each LS in the WAC need to be maintained and synchronized. The specific process of the data maintenance is as follows: When the user data in the WAC group are revised by a Background Administration Module (BAM) of a switch of an LS exchange and the WAC telephone station, the long number and short number corresponding table of the WAC 30 group on the ISP board of the LS is revised. Meanwhile, the long number and short number corresponding tables relating to the WAC group on the ISP boards of other exchange are also revised through SCCP signaling so as to implement automatic

cross-exchange user data maintenance. The specific process of the data synchronization is as follows: The long number and short number corresponding table of the WAC group on the ISP board will trigger the function of synchronized checking manually or periodically, which compares the long number and short number corresponding table with those saved in other exchanges within the WAC group to determine whether the tables are the same. If the tables are not the same, synchronized revision is performed, respectively, according to the data of the exchange to which the user belongs.

At present, WAC service can already be provided for users of PSTN, Public Lands Mobile Network (PLMN), and Next Generation Network (NGN) simultaneously.

In practical use, there are following problems in the above methods. The first method, in which the long number and short number transformation is implemented through the Intelligent Network, needs to save data and consume a great deal of resources in the intelligent SCP, resulting in heavy workload and high cost. The second method requires the existing switches to extend the ISUP interfaces, and corresponding data must be configured in all the switches, which involves changes to the switches of different manufacturers and different versions in the network, making quick implementation and wide application thereof difficult.

The reason for this situation is mainly that both methods require a lot of changes to the existing network without making full use of the techniques and facilities of the existing network.

### **Summary of the Invention**

In view of the above, the main objective of this invention is to provide a method for implementing the Wide Area Centrex, in which the WAC, covering the PSTN/PLMN users and the NGN users of different physical networks, are implemented without the need for any software or hardware changes to the switches in the existing network.

To achieve the above objective, this method provides a method for implementing WAC, in which the long number and short number corresponding relationship of the

WAC users is set and saved. And the key of the method is that the method also includes:

5 routing a call initiated by a calling user to a soft-switch, receiving by the soft-switch the call information initiated by the calling user, determining, based on the calling number, that the calling user is a WAC user before deciding the route to the called user based on the call information and completing the call.

10 When the calling WAC user is a NGN user and the called WAC user is a PSTN/PLMN user; the step of routing the call initiated by a user to the soft-switch is that the NGN user dials the short number of the called user, and initiates the call to the soft-switch; the step of receiving by the soft-switch the call information the calling user initiates is that the soft-switch directly receives the short number of the called user which the NGN user dials; and the step of determining the route to the called user and completing the call is that the soft-switch starts its own analysis of Centrex numbers, obtains the long number of the called user according to the saved  
15 corresponding relationship between long numbers and short numbers, routes the call to the LS to which the called user belongs according to the obtained long number and completes the call.

20 When the calling WAC user is a PSTN/PLMN user; the step of routing the call initiated by a user to the soft-switch is that the PSTN/PLMN user dials the out-group prefix of the WAC, and the call is routed to the soft-switch after the LS to which the PSTN/PLMN user belongs checks and determines that the out-group prefix is the out-group prefix of the WAC; the step of receiving by the soft-switch the call information the calling user initiates is that the soft-switch receives the out-group prefix the LS sends; the step of determining the route to the called user and completing the call is  
25 that the soft-switch obtains the data of the Centrex according to the calling number, starts its own analysis of Centrex numbers to determine that the call is an out-group call, deletes the out-group prefix and starts the process of handling an out-group call of the IP Centrex service.

30 When the calling WAC user is a PSTN/PLMN user; the step of routing the call initiated by a user to the soft-switch is that the PSTN/PLMN user dials the long number of the called user, and the call is routed to the soft-switch by the LS to which



the PSTN/PLMN user belongs according to the pre-planned routing data; the step of receiving by the soft-switch the call information the calling user sends is that the soft-switch receives the long number of the called which the LS sends; the step of determining the route to the called user and completing the call is that the soft-switch gets the data of the Centrex according to the calling number, starts its own analysis of Centrex numbers to determine that the call is an out-group call, and then starts the process of handling an out-group call of the IP Centrex service.

When the corresponding relationship of long number and short number of the WAC users is saved in the long number and short number corresponding table, wherein the long number and short number corresponding table is saved in the soft-switch, or saved in the peripherals of the soft-switch. Alternatively, the corresponding table is saved in a remote database, and then the method further includes: the soft-switch accessing the remote database directly or via proxy. Herein, the proxy is the local database.

The method further includes that the switches belonging to the same WAC service group determine the short number prefix and the out-group prefix of the WAC group through negotiation.

The main difference between the methods of the present invention and the prior art can be found by comparison: the WAC is implemented based on the soft-switch in the present invention, wherein the long number and short number corresponding table of the WAC is saved in the soft-switch or an external database it can access. Both the call of a PSTN/PLMN user and that of a NGN user in the group are routed to the soft-switch. The long number and short number transformation is performed according to the long number and short number corresponding table after an analysis of the calling number, and the call is routed to the called user according to the result of the transformation.

Such a difference between the methods brings apparent benefits, namely the soft-switch can be connected to the switches in the existing network by using the standard ISUP/Telephone User Part (TUP) protocol because the long number and short number transformation is performed in the soft-switch. So no development and upgrading of the existing switches are needed for implementing the WAC service. Furthermore, the

method of this invention based on soft-switch makes a full use of the process for handling a call of the IP Centrex, having less impact on the existing network while achieving high efficiency.

### **Brief Description of the Drawings**

5        Figure 1 shows the structure for implementing WAC through the IN of the prior art;

Figure 2 shows the structure for implementing WAC through distributed number memorization and transformation in the prior art;

10       Figure 3 is a schematic showing the structure for implementing WAC covering PSTN/PLMN users and NGN users in accordance with an embodiment of the present invention;

Figure 4 is a flow chart of a NGN user in the WAC group dialing short number to call a PSTN/PLMN user in the group in accordance with an embodiment of the present invention;

15       Figure 5 is a flow chart of a PSTN/PLMN user in the WAC group dialing an out-group prefix to call a PSTN/PLMN user or a NGN user in accordance with an embodiment of the present invention;

20       Figure 6 is a flow chart of a PSTN/PLMN user in the WAC group calling a PSTN/PLMN user or a NGN user directly in accordance with an embodiment of the present invention;

Figure 7 is a schematic of adopting an external additional information database in an embodiment of the present invention;

Figure 8 is a schematic of adopting a narrowband switch instead of the soft-switch in an embodiment of the present invention;

25       Figure 9 is a schematic of using a local database and a remote database in an embodiment of the present invention.

## **Detailed description of preferred embodiments**

To make the method and advantages of the present invention more apparent, the present invention will hereinafter be described in detail according to the accompanying drawings.

5 First, the NGN IP Centrex service will be described. The NGN IP Centrex service is a Centrex service built on a soft-switch system. Soft-switch is the core equipment used for dealing with call signaling, performing call control and implementing service in the NGN. Compared with the Centrex service provided by the traditional PSTN switch, new properties are added to the Centrex service provided  
10 by the system of soft-switch because the bearer of the system of soft-switch is a wideband IP data network. The user in a NGN IP Centrex group can be all kinds of users, such as ordinary users of voice service, multimedia users and etc. within the soft-switch domain, or PSTN/PLMN users connected with the soft-switch domain.

The basic principle of the present invention is: the WAC long number and short  
15 number corresponding table is saved in a place where the soft-switch can access; calls of the WAC users from PSTN/PLMN and NGN are all routed to the soft-switch, and whether the procedure for handling a WAC call is started or not is determined by recognizing the number of the calling; if it is determined to start the procedure, the function of long number and short number transformation, the function of number  
20 analysis and the function of call routing are performed. The WAC long number and short number corresponding table can be put in the soft-switch directly, or in the peripherals of the soft-switch, or in a remote database which the soft-switch can access via proxy.

Hereinafter, the implementation of the WAC service covering PSTN/PLMN  
25 users and NGN users will be described with reference to Figure 3.

As shown in Figure 3, the long number and short number corresponding table 60 covering PSTN/PLMN users and NGN users is embedded in soft-switch 50 in the NGN; LS23 of the PSTN domain and LS24 of the PLMN domain are connected to soft-switch 50 by means of trunk equipment, respectively; besides, WAC telephone  
30 station 70 used for uniformly maintaining the data of the group is also connected to



soft-switch 50; user 13 is a WAC user of the NGN domain, user 14 is a WAC user of the PSTN domain, and user 15 is a WAC user of the PLMN domain.

When implementing WAC based on soft-switch 50, the calls of NGN users in the same WAC group are handled as ordinary IP Centrex call without modification, because the call control and service implementation of calls from NGN users are originally performed by soft-switch 50. As far as PSTN/PLMN users in the WAC group are concerned, no hardware or software change to the relevant LS is needed while it is only needed to route the calls of WAC users to soft-switch 50 by means of data configuration. Calls from PSTN/PLMN users within a WAC group are mainly divided into 3 types: the short number Centrex call in the group, the Centrex call with out-group prefix, and the ordinary call. After soft-switch 50 determines that the call is a call from a PSTN/PLMN user in the WAC group through the process of recognizing the group of the calling, the call will be handled according to the uniform procedure of handling an ordinary IP Centrex call, thus making a full use of the existing IP Centrex procedure.

Procedures of various services are described in detail hereinafter.

The procedure of a NGN user in the WAC group calling a NGN user in the same WAC group: use the existing procedure for handling a call in IP Centrex service.

The procedure of a NGN user in the WAC group calling a NGN user who is not in the same WAC group: use the existing procedure for handling a call in IP Centrex service.

The procedure of a NGN user in the WAC group dialing an out-group prefix to call a PSTN/PLMN user: use the existing procedure for handling an out-group call in IP Centrex service.

The procedure of a NGN user in the WAC group dialing a short number to call a PSTN/PLMN user in the same WAC group includes the following steps as shown in Figure 4:

Step 401: The NGN user in the WAC group takes up the telephone and dials the short number of a PSTN or PLMN user within the group, sending a call to the soft-

switch. Herein, the NGN user is the calling user and the PSTN or PLMN user is the called user.

Step 402: Soft-switch 50 finds the call is an in-group call sent from a WAC user by the process of analyzing and recognizing the calling number in itself after  
5 receiving the short number the NGN user has dialed.

Step 403: Soft-switch 50 starts its own Centrex number analysis, searching the long number and short number corresponding table 60 saved in itself to get the long number of the called PSTN or PLMN user.

Step 404: After the long number is obtained, soft-switch 50 routes the call to the  
10 LS to which the called PSTN/PLMN user belongs according to the obtained long number to complete the call.

The procedure of a PSTN/PLMN user in the WAC group dialing the out-group prefix to call a PSTN/PLMN user or a NGN user includes the following steps as shown in Figure 5:

Step 501: The PSTN/PLMN user in the WAC group takes up the telephone and  
15 dials the out-group prefix of the WAC.

Step 502: The LS to which the PSTN/PLMN user in the WAC group belongs detects that the called prefix is an out-group prefix of a call in the WAC, and routes the call to soft-switch 50.

Step 503: Soft-switch 50 determines that the call is a call sent from a  
20 PSTN/PLMN user of the WAC by the process of analyzing and recognizing the calling number, and gets the relevant data of the Centrex user.

Step 504: Soft-switch 50 starts its own procedure of Centrex number analysis according to the called prefix received, and finds that this is an out-group call with the  
25 out-group prefix, then deletes the out-group prefix.

Step 505: Soft-switch 50 starts the process for handling an out-group call in IP Centrex service.

It should be noted here that the switches in the same WAC group need to determine the short-number prefix and the out-group prefix of the WAC group through negotiation. Herein, the short-number prefix of the group means the prefix of the short number of the WAC users, and generally speaking, it is used in number analysis when the user calls or the user is called.

The procedure of a PSTN/PLMN user in the WAC group calling a PSTN/PLMN user or a NGN user directly is shown in Figure 6:

Step 601: The PSTN/PLMN user in the WAC group takes up the telephone and dials the long number of the PSTN/PLMN user or the NGN user.

Step 602: The LS to which the PSTN/PLMN user in the WAC group belongs routes the call to soft-switch 50 according to the pre-configured routing data.

Step 603: Soft-switch 50 determines that the call is a call sent from a PSTN/PLMN user of the WAC by the analyzing process to recognize the calling number, and gets the relevant data of the Centrex user.

Step 604: Soft-switch 50 starts its own Centrex number analyzing procedure according to the called prefix received, and finds that this is an out-group call with out-group prefix. This step is different from Step 504 in that the out-group prefix need not be deleted.

Step 605: Soft-switch 50 starts the procedure for handling an out-group call in IP Centrex service.

In addition, there can be the following substitutions of the above-mentioned modes of implementation.

One substitution is: the long number and short number corresponding table is not saved in the soft-switch but in the peripherals of the soft-switch. As shown in Figure 7, the long number and short number corresponding table is saved in the additional information database in a preferred embodiment of the present invention. The additional information database is connected with the junction tandem exchange through Interface 1 and the additional information database in the present embodiment

is a local database. The soft-switch is used as a transit exchange in the embodiment as shown in Figure 7.

Another substitution is: the narrowband switch in the existing network is used instead of the soft-switch to realize WAC. In a preferred embodiment of the present invention as shown in Figure 8, a network node composed of the narrowband switch in the existing network instead of the soft-switch is connected with the LS, and the narrowband switch is also connected with an additional information database. The long number and short number corresponding table is saved in the additional information database and the additional information database in the present embodiment is a local database.

Yet another substitute method as shown in Figure 9 is: when the long number and short number corresponding table is not found in the local database, the soft-switch can access a remote database directly through Interface 3, or access the cross-region database via the local database through Interface 4. When Interface 4 is adopted, the local database acts as a proxy to search and obtain the additional information of the calling from the remote database, then passes the search result to the switch. Herein, both the local database and the remote database are the additional information database in which the long number and short number corresponding table is saved.

In the above three substitutions, Interface 1, Interface 3 and Interface 4 use standard interface in general. Obviously, the interface standard agreed by both sides through negotiation can also be used as long as information interaction can be implemented between the two sides.

Although the present invention has been illustrated and described according to preferred embodiments, it is apparent to those skilled in the art that there can be various changes in form and details, without departing from the scope and spirit of the invention as defined in the appended claims.